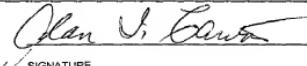


U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE FORM PTO-1390 (Modified) (REV 5-03)		ATTORNEY'S DOCKET NUMBER 038441/0104
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		
INTERNATIONAL APPLICATION NO. PCT/AU00/00416	INTERNATIONAL FILING DATE May 5, 2000	U.S. APPLICATION NO. (If known) Unassigned 09/831301
TITLE OF INVENTION ADJUVANT COMPOSITION FOR CHEMICALS USED IN AGRICULTURE		
APPLICANT(S) FOR DO/EO/US Robert W. KILLICK, Andrew R. JONES, Peter R. WRIGLEY and John D. MORRISON		
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:		
1. <input checked="" type="checkbox"/>	This is a FIRST submission of items concerning a filing under 35 U.S.C. 371.	
2. <input type="checkbox"/>	This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371.	
3. <input checked="" type="checkbox"/>	This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).	
4. <input checked="" type="checkbox"/>	A proper Demand for International Preliminary Examination was made by the 19 <sup>th</sup> month from the earliest claimed priority date.	
5. <input checked="" type="checkbox"/>	A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <input type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input checked="" type="checkbox"/> has been transmitted by the International Bureau. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US)	
6. <input type="checkbox"/>	A translation of the International Application into English (35 U.S.C. 371(c)(2)).	
7. <input checked="" type="checkbox"/>	Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input checked="" type="checkbox"/> have not been made and will not be made.	
8. <input type="checkbox"/>	A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).	
9. <input checked="" type="checkbox"/>	An oath or declaration of the Inventor(s) (35 U.S.C. 371(c)(4)).	
10. <input checked="" type="checkbox"/>	A copy of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).	
11. <input checked="" type="checkbox"/>	Applicant claims small entity status under 37 CFR 1.27.	
Items 12. to 17. below concern other document(s) or information included:		
12. <input type="checkbox"/>	An Information Disclosure Statement under 37 CFR 1.97 and 1.98.	
13. <input type="checkbox"/>	An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.	
14. <input checked="" type="checkbox"/>	A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment.	
15. <input type="checkbox"/>	A substitute specification.	
16. <input type="checkbox"/>	A change of power of attorney and/or address letter.	
17. <input type="checkbox"/>	Other items or information:	

U.S. APPLICATION NO. (if known) 37 CFR 1.490 Unassigned		INTERNATIONAL APPLICATION NO. 097831301 PCT/AU00/00416		ATTORNEY'S DOCKET NUMBER 038441/0104	
18. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY	
Basic National Fee (37 CFR 1.492(a)(1)-(5): Search Report has been prepared by the EPO or JPO.....\$860.00  International preliminary examination fee paid to USPTO (37 CFR 1.482).....\$690.00  No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) .....\$710.00  Neither international preliminary examination fee (37 CFR 1.482) nor International search fee (37 CFR 1.445(a)(2)) paid to USPTO ..... \$1,000.00  International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) .....\$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$1,000.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than 20 Months from the earliest claimed priority date (37 CFR 1.492(e))					
Claims	Number Filed	Included in Basic Fee	Extra Claims	Rate	
Total Claims	45	-	20	= 25 x \$18.00	\$450.00
Independent Claims	17	-	3	= 14 x \$80.00	\$1120.00
Multiple dependent claim(s) (if applicable)				\$270.00	
TOTAL OF ABOVE CALCULATIONS =				\$2,570.00	
Reduction by 1/2 for filing by small entity, if applicable.				\$1,285.00	
SUBTOTAL =				\$1,285.00	
Processing fee of \$130.00 for furnishing English translation later the 20 months from the earliest claimed priority date (37 CFR 1.492(f)).				+ \$1,285.00	
TOTAL NATIONAL FEE =				\$1,285.00	
Fee for recording the enclosed assignment (37 CFR 1.24(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +					
TOTAL FEES ENCLOSED =				\$1,285.00	
				Amount to be: refunded \$ _____ charged \$ _____	
a. <input checked="" type="checkbox"/>	A check in the amount of <u>\$1,285.00</u> to cover the above fees is enclosed.				
b. <input type="checkbox"/>	Please charge my Deposit Account No. <u>19-0741</u> in the amount of \$. to the above fees. A duplicate copy of this sheet is enclosed.				
c. <input checked="" type="checkbox"/>	The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u>19-0741</u> . A duplicate copy of this sheet is enclosed.				
NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.					
SEND ALL CORRESPONDENCE TO:			 SIGNATURE		
Foley & Lardner Washington Harbour 3000 K Street, N.W., Suite 500 Washington, D.C. 20007-5109			NAME ALAN I. CANTOR		
			REGISTRATION NUMBER 28,163		

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Attorney Docket No. 038441/0104

In re patent application of )  
Robert W. KILLICK, Andrew R. KILLICK, ) Group Art Unit: TBA  
Peter W. JONES, Peter R. WRIGLEY and )  
John D. MORRISON )  
Serial No.: TBA ) Examiner: TBA  
Filed: May 5, 2000 (as PCT/AU00/00416) )  
For: ADJUVANT COMPOSITION FOR )  
CHEMICALS USED IN AGRICULTURE )

**PRELIMINARY AMENDMENT**

Commissioner for Patents  
Washington, D.C. 20231

Sir:

Examination of this national stage application is based on the application as amended during the international stage (Chapter II) on February 2, 2001, viz:  
original pages 7-23 of the description;  
revised pages 1-6a of the description; and  
revised claims 1-45 (pages 24-29).

See the International Preliminary Examination Report and annexes thereto.

Prior to examination on the merits, please amend the application as follows.

**IN THE CLAIMS**

In accordance with 37 C.F.R. §1.121(c)(3), please substitute for pending claims 1-33 the following clean version of the claims, in which claims 18, 27 and 29 have been amended, and new claims 34-45 have been added. The changes to claims 18, 27 and 29 are shown explicitly in the attached "Marked-up Version Showing Changes Made."

1. A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers having cationic characteristics in acidic conditions and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
2. An adjuvant according to claim 1 comprising:
- (a) from 5 to 55% by weight of one or more lipophilic solvents;
  - (b) from 1 to 30% by weight of one or more lipophobic plant nutrients; and
  - (c) from 1 to 15% of a mixture of one or more cationic emulsifiers.
3. An adjuvant according to claim 2 comprising:
- (a) from 15 to 35% by weight of one or more lipophilic solvents;
  - (b) from 5 to 25% by weight of one or more lipophobic plant nutrients; and
  - (c) from 1 to 10% of a mixture of one or more cationic emulsifiers.
4. An adjuvant according to claim 1 wherein the lipophilic solvent is selected from the group consisting of petroleum fractions, vegetable oils, synthetic triglycerides, alkyl esters of fatty acids, fatty alcohols, guerbet alcohols or any mixture thereof.

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- 
5. An adjuvant according to claim 4 wherein the lipophilic solvent comprises a petroleum fraction.
  6. An adjuvant according to claim 5 wherein the petroleum fraction is a mineral oil.
  7. An adjuvant according to claim 4 wherein the lipophilic solvent comprises an alkyl ester of a fatty acid.
  8. An adjuvant according to claim 7 wherein the fatty acid of the alkyl ester of a fatty acid has an alkyl moiety derived from the simple alcohols methanol, ethanol, propanol or butanol.
  9. An adjuvant according to claim 7 wherein the alkyl ester of a fatty acid is derived from natural oils and fats, specific blends produced by fatty acid manufacturers or from fatty acids produced by synthetic means.
  10. An adjuvant according to claim 9 wherein the natural oils and fats are selected from the group consisting of lard, tallow, vegetable oils and mixtures thereof.
  11. An adjuvant according to claim 1 wherein the lipophobic plant nutrients comprise one or more ammonium salts of inorganic ions.
  12. An adjuvant according to claim 11 wherein the ammonium salts of inorganic ions are selected from the group consisting of ammonium sulfate, ammonium phosphate and mixtures thereof.
  13. An adjuvant according to claim 12 wherein the ammonium salt of inorganic ions is ammonium sulfate.
  14. An adjuvant according to claim 1 wherein the cationic emulsifiers are selected from fatty amines, fatty amine oxides or mixtures thereof.
  15. An adjuvant according to claim 1 wherein the cationic emulsifiers are quaternary cationic emulsifiers.

16. An adjuvant according to claim 1 wherein the cationic emulsifiers are selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethylammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof.
17. An adjuvant according to claim 16 wherein the cationic emulsifiers are selected alkyltrimethylammonium chloride, dimethyllaurylamine oxide or mixtures thereof.
18. (Amended) An adjuvant according to claim 1 further comprising one or more other components to improve the form of the composition.
19. An adjuvant according to claim 18 wherein the other component is selected from nonionic emulsifiers, co-solvents and mixtures thereof.
20. An adjuvant according to claim 18 wherein the other component is a mixture of one or more nonionic emulsifiers.
21. An adjuvant according to claim 19 wherein the nonionic emulsifiers are selected from the group consisting of alkyl polysaccharides, sorbate emulsifiers, alcohol ethoxylates, fatty alkanolamides or mixtures thereof.
22. An adjuvant according to claim 18 wherein the other component is a co-solvent.
23. An adjuvant according to claim 22 wherein the co-solvent is selected from the group consisting of propylene glycol, 1,3-butanediol, hexylene glycol, polypropylene glycols, ethanol or mixtures thereof.
24. An adjuvant according to claim 6 wherein the cationic emulsifiers are quaternary cationic emulsifiers.
25. An adjuvant according to claim 24 further comprising nonionic emulsifiers selected from the group consisting of alkylpolysaccharides, fatty alkanolamide, sorbitan monooleate, alcohol ethoxylate and mixtures thereof.

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26. An adjuvant according to claim 24 further comprising co-solvents selected from the group consisting of 1,3-butanediol, ethanol and mixtures thereof.
27. (Amended) An adjuvant according to claim 1 wherein a mixture of at least two cationic emulsifiers is used.
28. An adjuvant according to claim 27 wherein the mixture of cationic emulsifiers comprises fatty quaternary ammonium chlorides and/or fatty amine oxides in conjunction with fatty alkyldimethylamine salts of simple organic acids.
29. (Amended) An adjuvant according to claim 1 further comprising one or more other available adjuvant components.
30. An agrochemical composition comprising a chemical used in agriculture and an activity enhancing amount of a homogeneous liquid adjuvant, said homogeneous liquid adjuvant comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
31. A homogeneous liquid adjuvant when used with a chemical used in agriculture comprising:

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- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
- (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions or mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

32. A method for enhancing the activity of a chemical used in agriculture comprising the step of combining the chemical with a homogeneous liquid adjuvant comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

33. A method of treating vegetation comprising the step of applying an agrochemical composition comprising a chemical used in agriculture and a homogeneous liquid adjuvant comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
34. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) from 15 to 35% by weight of one or more mineral oils;
  - (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions; and
  - (c) from 1 to 10% of one or more cationic emulsifiers selected from the group consisting of fatty amines, fatty amine oxides and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

35. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) from 15 to 35% by weight of one or more mineral oils;
  - (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof; and
  - (c) from 1 to 10% of one or more cationic emulsifiers selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethyl-ammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof;  
wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
36. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) from 15 to 35% by weight of one or more mineral oils;
  - (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;
  - (c) from 1 to 10% of one or more cationic emulsifiers selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethyl-ammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof; and

- (d) from 1 to 30% of one or more other components to improve the form of the composition;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

37. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more mineral oils;
- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;
- (c) from 1 to 10% of one or more cationic emulsifiers selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethyl-ammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition selected from nonionic emulsifiers, co-solvents and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

38. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more mineral oils;

- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;
- (c) from 1 to 10% of one or more cationic emulsifiers selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethyl-ammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition selected from alkyl polysaccharides, sorbate emulsifiers, fatty alkanolamides, glycols and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
39. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients;
- (c) not in excess of about 50% of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers having cationic characteristics in acidic conditions and mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition.

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

40. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients;
- (c) not in excess of about 50% of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers having cationic characteristics in acidic conditions and mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition selected from the group consisting of nonionic emulsifiers, co-solvents and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

41. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more alkyl esters of fatty acids;
- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions; and
- (c) from 1 to 10% of a mixture of two or more cationic emulsifiers selected from the group consisting of fatty quaternary ammonium chlorides, fatty

amine oxides, fatty alkyldimethylamine salts of simple organic acids and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

42. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more alkyl esters of fatty acids;
- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof; and
- (c) from 1 to 10% of a mixture of two or more cationic emulsifiers selected from the group consisting of fatty quaternary ammonium chlorides, fatty amine oxides, fatty alkyldimethylamine salts of simple organic acids and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

43. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more alkyl esters of fatty acids;
- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;

- (c) from 1 to 10% of a mixture of two or more cationic emulsifiers selected from the group consisting of fatty quaternary ammonium chlorides, fatty amine oxides, fatty alkylidimethylamine salts of simple organic acids and mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

44. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
- (a) from 15 to 35% by weight of one or more alkyl esters of fatty acids;
  - (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;
  - (c) from 1 to 10% of a mixture of two or more cationic emulsifiers selected from the group consisting of fatty quaternary ammonium chlorides, fatty amine oxides, fatty alkylidimethylamine salts of simple organic acids and mixtures thereof; and
  - (d) from 1 to 30% of one or more other components to improve the form of the composition selected from nonionic emulsifiers, co-solvents and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

45. (New) A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:

- (a) from 15 to 35% by weight of one or more alkyl esters of fatty acids;
- (b) from 5 to 25% by weight of one or more ammonium salts of inorganic anions selected from ammonium sulfate, ammonium phosphate and mixtures thereof;
- (c) from 1 to 10% of a mixture of two or more cationic emulsifiers selected from the group consisting of fatty quaternary ammonium chlorides, fatty amine oxides, fatty alkyldimethylamine salts of simple organic acids and mixtures thereof; and
- (d) from 1 to 30% of one or more other components to improve the form of the composition selected from alkyl polysaccharides, sorbate emulsifiers, fatty alkanolamides, glycols and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

**REMARKS**

Claims 18 and 29 have been amended to place them in better form for examination by eliminating multiple dependencies. Claim 27 has been broadened by changing its dependency, and improved in form by referring back to the "mixture" recited in parent claim 1. New claims 34-45 round out the protection sought for the invention.

Respectfully submitted,



Alan I. Cantor  
Reg. No. 28,163

May 8, 2001  
Date

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SEARCHED  
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JUN 12 2001  
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**MARKED-UP VERSION SHOWING CHANGES MADE**

18. (Amended) An adjuvant according to [any one of the preceding claims] claim 1 further comprising one or more other components to improve the form of the composition.
  
27. (Amended) An adjuvant according to claim [7] 1 wherein a mixture of at least two cationic emulsifiers [are] is used.
  
29. (Amended) An adjuvant according to [any one of the preceding claims] claim 1 further comprising one or more other available adjuvant components.

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JC08 Rec'd PCT/PTO 08 MAY 2001

Adjuvant Composition for Chemicals Used in Agriculture

**Field of the invention**

The invention relates to an adjuvant for use with chemicals used in agriculture. More 5 particularly, the adjuvant of the invention is particularly adapted for use with herbicides.

**Background of the invention**

In this specification, where a document, act or item of knowledge is referred to or discussed, this reference or discussion is not to be taken as an admission that the document, act or item of knowledge or any combination thereof was at the priority date:

- 10 (a) part of common general knowledge; or  
15 (b) known to be relevant to an attempt to solve any problem with which this specification is concerned.

Whilst the following discussion highlights the invention with relation to herbicides, it is believed that the same principles apply to other chemicals used in agriculture, such as, 15 plant hormones, insecticides, crop desiccants or crop defoliants.

Farmers rotate the use of their fields to allow the fields to regain their fertility. This means that at any one time there will be fields with crops and fields left bare. The bare fields are said to be fallow fields.

Weeds will still grow on the fallow fields, and while they will not be competing with a 20 crop for nutrients or space, if they are left alone they will produce many seeds which will germinate and be a problem when the field is again used for crops. As a result, the farmer will spray the fallow fields with herbicide to kill the weeds. Since there is no crop on fallow fields, a non-selective herbicide can be used, such as glyphosate. Non-selective herbicides can also be used to control weeds in cropping situations where the 25 crop has either been bred or genetically modified to be resistant to the herbicide.

There is a growing trend to produce adjuvants to improve the efficacy of agrochemicals, including herbicides. For example, in Australian patent application number 62833/98, an adjuvant for use with herbicides, crop defoliants and desiccants is disclosed including esters of fatty acids and nonionic emulsifiers.

Glyphosate is the most widely used non-selective herbicide for both fallow and cropping situations worldwide. Currently, a farmer may prepare the glyphosate spray with several additives to improve its efficacy. For example, it is known to add ammonium salts to improve the efficacy of glyphosate. The reasons for this improvement are not well understood and it is a complicated area of chemical and botanical reactions. However, it is believed that some anions can minimize the deleterious effect of hard water on herbicidal performance and the ammonium cation provides nutrition for the plant which enhances the uptake and translocation of the herbicide by the plant. Wetting agents are also used to improve leaf coverage. Petroleum fractions or other lipophilic materials (hereinafter referred to as lipophilic solvents) are used, especially in the summer months, to keep the herbicide in liquid form as the herbicide will be ineffective once it dries on the foliage.

The farmer may combine all these additives with the herbicide when the tank mix is prepared but the farmer may not know whether these components are compatible with each other. Some additives or adjuvants can actually antagonise each other and decrease the activity of the agrochemical. It is also inconvenient since there are several components which must be bought, measured and combined.

Farmers are always looking for more efficacious and convenient ways to enhance the performance of active ingredients. They would also prefer to simply add one composition which they know will enhance the efficacy of the herbicide rather than deal with several components where the resultant effect is unknown.

#### **Summary of the invention**

It was envisaged that incorporating ammonium salts into lipophilic solvent-based adjuvants would produce an adjuvant which provides active ingredient enhancement in several different ways. It was thought that the ammonium salts (a source of nitrogen) would enhance translocation through the fertilizer effects and could also increase leaf permeability, and the appropriate anion would reduce the effects of water hardness, whilst the lipophilic solvents would increase the availability of the active on the target and subsequently the absorption of the active into the target. However, preparing a stable homogeneous blend of lipophilic solvent with ammonium salts, particularly those which minimize the detrimental effects of hard water has not been easy to achieve

because such salts are not soluble in lipophilic solvents. Hence, evaluating such a product as an adjuvant has not been possible.

It has been found that a homogeneous blend which is stable within normal storage conditions can be made which includes lipophilic solvents and lipophobic plant

5 nutrients (such as ammonium salts) using cationic emulsifiers as a coupling agent.

According to the invention, a homogeneous liquid adjuvant for use with a chemical used in agriculture is provided comprising:

- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
- (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers having cationic characteristics in acidic conditions and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

Preferably, the adjuvant comprises:

- (a) from 5 to 55% by weight of one or more lipophilic solvents;
- (b) from 1 to 30% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
- (c) from 1 to 15% of a mixture of one or more cationic emulsifiers.

More preferably, the adjuvant comprises:

- (a) from 15 to 35% by weight of one or more lipophilic solvents;
- (b) from 5 to 25% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
- (c) from 1 to 10% of a mixture of one or more cationic emulsifiers.

The above proportions are based on the dry weight of the plant nutrients and cationic emulsifiers. It is common for these products to be supplied in aqueous or other diluted

forms. It will be necessary to determine actual concentrations of these components prior to using these diluted products in a composition according to the invention.

The lipophilic solvents may be petroleum fractions, vegetable oils, synthetic triglycerides, alkyl esters of fatty acids, fatty alcohols, guerbet alcohols or any mixture

- 5 thereof. Preferably, a petroleum fraction is used as it is more cost effective. More preferably, the petroleum fraction is a mineral oil. These mineral oils, for example, can be 70, 100 or 150 sec solvent neutral.

If alkyl esters of fatty acids are used then the alkyl moiety can be derived from the simple alcohols such as methyl-, ethyl-, butyl or propyl alcohols. There are innumerable

- 10 variations of the esters of fatty acids which may be produced from the natural oils and fats such as lard, tallow and vegetable oils, such as canola, corn, sunflower and soyabean oils, or from specific blends produced by fatty acid manufacturers or from fatty acids produced by synthetic means.

The lipophobic plant nutrients include ammonium salts of inorganic anions (such as ammonium sulphate and phosphates) which are known to minimise the deleterious effects of hard water on herbicide performance. Preferably, the ammonium salt is ammonium sulphate. If an anhydrous ammonium salt is used then water may need to be added to the composition. However, if the ammonium salt is already in solution then additional water may not be necessary.

- 20 The term "cationic emulsifiers" is used to include emulsifiers which are commonly classified as cationic as well as those which exhibit cationic properties in acidic conditions. An example of an emulsifier which is commonly classified as cationic is a quaternary cationic emulsifier. Examples of emulsifiers which exhibit cationic properties in acidic conditions are fatty amines, amine oxides and amine ethoxylates. Amphoteric emulsifiers 25 such as betaines may also exhibit such properties.

Preferably, the cationic emulsifiers are selected from dimethylcocoamine, dimethyl-laurylamine oxide, alkyltrimethylammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof. More preferably, the cationic emulsifier is selected from alkyltrimethylammonium chloride, 30 dimethyl lauryl amine oxide or mixtures thereof.

Preferably, the adjuvant composition comprises other components to improve the form of the composition. These other components may be added to form a micro-emulsion. The other components may be selected from the group consisting of nonionic emulsifiers, co-solvents and mixtures thereof.

5 Preferably, the nonionic emulsifiers are alkyl polysaccharides, sorbate emulsifiers, alkyl bearing ethoxylates or fatty alkanolamides. Alkyl polysaccharides are sometimes called alkyl polyglucosides, alkyl glucosides or alkyl saccharides. The sorbate emulsifiers are sorbitan mono- (or sesqui-) esters of fatty acids and include sorbitan mono-oleate and sorbitan monolaurate. Preferably, the sorbate emulsifier is sorbitan mono-oleate. An

10 example of a fatty alkanolamide is oleyldiethanolamide. The co-solvents include propylene glycol, 1,3-butanediol, hexylene glycol, polypropylene glycols and ethanol. Anionic emulsifiers may be added when compatible with the other components.

15 When mineral oils are used as the lipophilic solvent and ammonium sulphate is used as the plant nutrient, preferably, the composition comprises a cationic emulsifier, the following nonionic emulsifiers: alkylpolysaccharides, fatty alkanolamide and sorbitan mono-oleate or alcohol ethoxylate, as well as the following co-solvents: 1,3-butanediol and ethanol.

When esters of fatty acids are used as the lipophilic solvent, preferably, a mixture of at least two cationic emulsifiers are used. One of the cationic emulsifiers may be an amphoteric emulsifier acting as a cationic emulsifier. More preferably, the mixture of 20 cationic emulsifiers comprises fatty quaternary ammonium chlorides or fatty amine oxides in conjunction with fatty alkyldimethylamine salts of simple organic acids. For example, the fatty alkyldimethylamine salts of simple organic acids could be cocodimethylamine or lauryldimethylamine with citric acid. Other simple organic acids include acetic, 2-ethylhexanoic acid, tartaric, maleic and lactic acid.

25 In another preferred form of the invention, the adjuvant for use with a chemical used in agriculture further comprises one or more other available adjuvant components. The adjuvant component may be selected from pH modifiers, spray drift retardants, stickers, rainfasteners and wettters.

According to another embodiment of the invention, there is provided an agrochemical composition comprising a chemical used in agriculture and an activity enhancing amount of a homogeneous liquid adjuvant, said homogeneous liquid adjuvant comprising:

- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - 5 (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
  - 10 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
- According to a further embodiment of the invention, there is provided a homogeneous liquid adjuvant when used with a chemical used in agriculture comprising:
- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - 15 (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
  - 20 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

According to an even further embodiment of the invention, there is provided a method for enhancing the activity of a chemical used in agriculture comprising the step of combining the chemical with a homogeneous liquid adjuvant comprising:

- (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- 5 (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
- (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;

10 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

According to another embodiment of the invention, there is provided a method of treating vegetation comprising the step of applying an agrochemical composition comprising a chemical used in agriculture and a homogeneous liquid adjuvant comprising:

- 15 (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients (such as ammonium salts of inorganic anions); and
- (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;

20 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

### Examples

The invention will now be further explained and illustrated by the following non-limiting examples.

#### Lipophilic solvents, cationic emulsifiers, plant nutrients and other components used

1,3 Butanediol	ex Hoechst Celanese, USA
'880' ammonia	ex Orica, Australia
Acetic acid glacial	ex Orica, Australia
Algene SC25	25% paste of stearyldimethylbenzyl ammonium chloride ex ICI Ltd, UK
Alkadet 15	70% solution of alkyl polysaccharide ex Huntsman Corporation, Australia
Ammonium nitrate	> 99% purity ex Orica, Australia
Ammonium sulphate	>99% purity ex Redox, Australia
BS 1000	commercial adjuvant containing alcohol alkoxylate ex Cropcare, Australia
Cation BB	lauryltrimethyl ammonium chloride in a 30% solution containing salt ex AMTRADE Australia
Citric acid	ex Citrique Belge, Belgium
Dimethyl cocoamine	ex Proctor & Gamble, USA
Dimethyl laurylamine	ex Fina Chemicals, Belgium
Empigen BB	28% solution of cocobetaine ex Albright and Wilson, Australia
Ethanol	ex CSR, Australia and contains 2-3% methanol.
Ethyl oleate	ex Victorian Chemical Company, Australia and contains approximately 80% w/w ethyl and 20% w/w methyl esters of canola oil.
Glyphosate CT solution	commercial herbicide containing 450 g/L glyphosate ex Nufarm, Australia
HASTEN	commercial adjuvant containing 704 g/l ethyl oleate ex Victorian Chemical Company, Australia

Lactic acid	88% solution ex Musashima, Japan
Liase	commercial adjuvant containing 417 g/l ammonium sulphate ex Nufarm, Australia
LI700	commercial adjuvant containing 345 g/l phospholipids and 355g/l propionic acid ex Nufarm, Australia
Lorol C1298	Laurylalcohol ex Henkel, Australia
Oleylamine	ex Fina Chemicals, Belgium
Oxamin LO	30% solution of lauryldimethylamine oxide ex Huntsman Corporation, Australia
Potassium ammonium phosphate	46% aqueous solution ex Wilbur Ellis Company, USA
Propylene glycol	industrial grade ex Dow Chemicals, Australia
Prorex 36	100 sec solvent neutral mineral oil ex Mobil, Australia
Quatramine C16/29	29% solution of cetyltrimethyl-ammonium chloride ex APS Chemicals, Australia
Quatramine NC50	50% solution of alkyldimethylbenzyl ammonium chloride ex APS Chemicals, Australia
Radiaquat 6465	30% solution of lauryl trimethyl ammonium chloride ex Fina Chemicals, Belgium
Roundup CT Xtra	commercial herbicide containing 490 g/L glyphosate ex Monsanto, Australia
Shell P830	paraffinic 70 sec oil ex Shell, Australia
Span 80	sorbitan mono-oleate ex Huntsman Corporation, Australia
Teric N2	nonylphenol 2 moles ethylene oxide ex Huntsman Corporation, Australia

Teric N9	nonylphenol 9 moles ethylene oxide ex Huntsman Corporation, Australia
Terwet 3001	70% solution of alkyl polysaccharide ex Huntsman Corporation, Australia
Tridecanol	ex Shell Chemicals, Australia
Urea	ex Orica, Australia
Vicamid 825	oleyldiethanolamide ex Victorian Chemical Company, Australia
VOC RHT 100	paraffinic 100 sec oil ex Safety Kleen, USA
Winter Oil	commercial adjuvant containing emulsified mineral oil ex BP, Australia

**Example 1**

In this example, low levels of glyphosate were used to treat a broadleaf weed and a grass weed.

**5 Adjuvant compositions tested**

The following adjuvant formulations were prepared and are stable compositions. A formulation was classified as stable if it remained a clear liquid without detectable phase separation for at least 48 hours through the temperature range 0 to 40°C. Adjuvant D which is an oil-in-water emulsion was only tested at room temperature.

- 10 The proportions are shown as percentage by weight.

lipophilic solvent	Adjuvant	plant nutrient	cationic emulsifier	other components	Span 80	
					Ethanol	Alkadet 15
				Radiaquat 6465		
				Added Water		
				Urea		
		Potassium ammonium phosphate				
		Ammonium sulfate				
		Ammonium nitrate				
A	-	28	16	-	12	16
B	-	22	-	17	-	39
C	-	26	-	-	50	-
D	25	-	-	-	47	-
					6	3
					9	4
					7	-
					7	7
					6	-

Note that there was no water added to Adjuvant C but there was a water content of about 30%.

The above adjuvants were tested by combining the adjuvant with Glyphosate CT in a water-based tank mix. Compositions 2 to 14 below are spray tank mixtures containing glyphosate and other components as listed.

The spray tank mixture was applied to the plants at a rate equivalent to 64 litres/hectare.

- 5 The glyphosate used was the commercially available Glyphosate CT at a rate equivalent to either 60 g a.i/hectare or 120 g a.i/hectare which is 12.5% and 25% respectively of the normal application rate. The adjuvants were added volumetrically to the tank mix as a percentage of the tank mix volume.

#### Compositions tested.

Composition	Other Components
1.	unsprayed control
2.	no other components
3.	0.2% BS 1000
4.	1.0% Winter Oil
5.	2.0% Liase
6.	0.2% BS 1000, 1.0% Winter Oil and 2.0 % Liase
7.	0.75% of Adjuvant A
8.	1.5% of Adjuvant A
9.	0.75% of Adjuvant B
10.	1.5% of Adjuvant B
11.	0.75% of Adjuvant C
12.	1.5% of Adjuvant C
13.	0.75% of Adjuvant D
14.	1.5% of Adjuvant D

### **Spiny Emex**

The above compositions were tested on spiny emex shoots which is a broad leaf weed. The level of effectiveness of each composition was determined using the fresh weight of the weed 31 days after the spray application. The results are an average of seven replicates.

5

The lower the fresh weight of the weed the more effective the composition.

#### **Test results with spiny emex shoots**

<b>Composition</b>	<b>Fresh weight (g)</b>	
	<b>(60 g/ha glyphosate)</b>	<b>(120 g/ha glyphosate)</b>
1. (control)	15.1	15.1
2.	14.0	9.8
3.	13.2	8.5
4.	12.1	7.1
5.	11.0	6.5
6.	13.0	8.8
7.	12.2	5.3
8.	10.8	5.0
9.	7.9	4.0
10.	6.1	3.5
11.	10.8	6.8
12.	6.9	4.2
13.	9.2	3.0
14.	5.5	3.6

Analysis

These results illustrate that when using low levels of glyphosate on a broadleaf weed, Compositions 7 to 14 are more efficient than Composition 2 which is glyphosate alone therefore Adjuvants A to D are acting as adjuvants. At 120g/ha, Compositions 7 to 14 are significantly better than Composition 2. At 60g/ha, the effectiveness of Compositions 7 to 14 depended on the amount of adjuvant used and the composition of the adjuvant. Adjuvants B and D had superior results at both concentrations.

Compositions 7 to 14 compared favorably to Compositions 3 to 6 which contain commercially available adjuvants. At 120g/ha, Compositions 7 to 10 and 12 to 14 had superior results to Compositions 3 to 6. At 60 g/ha, depended on the adjuvant used and the amount of adjuvant used. Adjuvants B and D had superior results at both concentrations.

Compositions 7 to 14 are also more efficient than the mere combination of additives in Composition 6. Therefore, the invention provides an adjuvant for a herbicide in a single homogeneous composition which is more effective than the mixture which a farmer would obtain if the commonly used additives were simply mixed together in the tank mix.

**Ryegrass**

The above compositions were tested on ryegrass shoots which is a grass. The fresh weight (grams) of the weeds were measured 19 days after the spray application. The results are an average of eight replicates.

**Test results for ryegrass shoots**

Composition	Fresh weight (g)	
	(60 g/ha glyphosate)	(120 g/ha glyphosate)
1.	4.0	4.0
2.	3.0	2.0
3.	3.75	0.75
4.	3.5	0.75
5.	2.0	1.0
6.	2.0	1.0
7.	3.5	1.5
8.	2.75	1.0
9.	1.75	0.5
10.	1.25	0.25
11.	1.75	0.5
12.	1.75	0.25
13.	2.25	0.25
14.	1.25	0.25

Analysis

These results illustrate that Compositions 9 to 14 are clearly more efficient than  
5 Composition 2 which is glyphosate alone and thus that Adjuvants B, C and D are acting  
as adjuvants.

Compositions 9 to 14 compared favorably to Compositions 3 to 6. The results depended  
on the adjuvant used and the amount of adjuvant used.

At the lowest glyphosate level (60g/ha) the best results were achieved with Adjuvants B and D at the higher rates (Compositions 10 and 14). These compositions are clearly more efficient than Compositions 3 to 6.

At the higher glyphosate level (120g/ha). Compositions 9 to 14 are clearly more efficient than Compositions 3 to 6. Adjuvants B, C and D had superior results.

Adjuvant A (represented by Compositions 7 and 8) was less effective on ryegrass shoots at the lower glyphosate level but of comparable performance as Compositions 5 and 6 at the higher glyphosate level.

#### **Example 2**

- 10 In this example, the effect of external conditions and hard water are tested. Hard water has been shown to reduce the efficacy of glyphosate. Higher temperatures increase the evaporation rate of the spray water and thereby can leave the glyphosate dry on the foliage rendering it less available for absorption into the plant.
- 15 Water hardness is measured in World Health Organisation units of hardness (WHO). One WHO is equivalent to 343 ppm of CaCO<sub>3</sub>.
- The test compositions were tested on ryegrass using water of three differing degrees of hardness: Melbourne tap water (typically 20 ppm), 1WHO and 3WHO water. The fresh weight (grams) of the weeds were measured 19 days after spray application. The results are an average of seven or eight replicates.
- 20 The test compositions were tested on ryegrass exposed to two differing environmental temperature conditions (Standard and Hot) for one hour before and two hours after spraying. Standard temperature was that of the controlled greenhouse (approximately 20°C) whereas Hot temperature was induced in a 30°C constant environment room. The fresh weight of the weeds was measured 21 days after spraying. The results are an average of eight replicates.
- 25

The following adjuvants are stable compositions and were tested in Example 2.

Component	Adjuvant		
	E	F	
Lipophilic solvent	Prrex 36	22	21
Plant nutrient	Ammonium Sulphate	15	14
	Water	30	30
Cationic Emulsifier	Quatramine C16/19	12	7
	Algène SC25	-	7
Other Components	1,3 Butanediol	4	4
	Ethanol	2	2
	Span 80	6	6
	Terwet 3001	6	6
	Vicamid 825	3	3

The above adjuvants were tested by combining the adjuvant with Glyphosate CT in a water-based tank mix. Compositions 16 to 23 are spray tank mixtures containing 5 glyphosate and other components as listed.

The glyphosate was applied at 120g ai/ha (25% of the normal application rate).

<b>Composition</b>	<b>Other Components</b>
15.	unsprayed control
16.	no other components
17.	0.25% LI700
18.	0.25% Adjuvant E
19.	1.0% Adjuvant E
20.	0.25% Adjuvant F
21.	0.1% BS1000 and 2.0% Liase
22.	0.25% HASTEN
23.	Roundup CT Xtra (used in place of Glyphosate CT to provide an equivalent amount of glyphosate)

#### Test results for ryegrass shoots

<b>Composition</b>	<b>Tap/ Standard</b>	<b>1WHO</b>	<b>3WHO</b>	<b>Hot</b>
15.	1.726	1.726	1.726	1.726
16.	0.292	0.871	1.696	0.455
17.	0.401	0.487	1.185	0.647
18.	0.139	0.364	1.571	0.315
19.	0.157	0.184	0.312	0.173
20.	0.199	0.425	1.057	0.315
21.	0.127	0.130	0.158	0.266
22.	0.186	0.325	1.588	0.223
23.	0.264	0.534	1.684	0.293

**Effect of Water Hardness**

The results for Compositions 16 and 23 clearly indicate that hard water reduces the efficacy of glyphosate. Composition 21 illustrates that the use of ammonium sulphate improves the performance of glyphosate in hard water. Composition 19 which contains an adjuvant according to the invention achieved excellent results in all of the conditions. Compositions 18 and 20 illustrate that to achieve the suitable results a sufficient amount of adjuvant must be used such as that in Composition 19.

Adjuvant E (in Composition 19) is clearly effective as an adjuvant for reduced levels of glyphosate on ryegrass in the presence of hard water. As with Liase and other ammonium sulphate bearing adjuvants, the amount of Adjuvant E must be adjusted to meet the degree of water hardness.

**Effect of Temperature Conditions**

The performance of glyphosate is clearly reduced in Hot conditions. Compositions 18 and 20 contained 0.25% of an adjuvant according to the present invention and achieved comparable results to the known additives. Composition 19 which contained 1.0% of an adjuvant according to the invention continued to perform well under Hot conditions. Under Hot conditions, Composition 19 actually performed as well as compositions with known additives under Standard conditions.

The Hot conditions resulted in higher fresh weights. Composition 19 clearly resisted this decrease in performance in a satisfactory manner. Adjuvant E (in Compositions 18 and 19) is clearly effective as an adjuvant for reduced levels of glyphosate on ryegrass in Hot conditions when used in appropriate amounts.

**Example 3**

This example investigated the formulation stability when another typical adjuvant component is added. The additional component tested was BIVERT concentrate which is the active ingredient of BIVERT, a spray drift retardant ex Wilbur-Ellis Company.

The following compositions were prepared as homogeneous blends. All proportions are by weight. All the ingredients except for the citric acid were stirred together. Then

enough citric acid was then added with stirring to clear the mixture and give high temperature stability.

Each of the adjuvants G, H and I were found to be homogeneous blends which remained clear without phase separation for at least 48 hours through the temperature range 0 to 5 40°C.

#### **Adjuvant compositions with spray drift retardant**

<b>Component</b>		<b>Adjuvant</b>		
		<b>G</b>	<b>H</b>	<b>I</b>
Lipophilic solvent	Ethyl oleate	30	30	30
Plant nutrient	Ammonium sulphate	-	-	10
	Potassium ammonium phosphate	20	20	-
	Water	10	10	20
Cationic Emulsifier	Dimethyl laurylamine	10	10	10
	Quatramine C16/29	-	6	6
	Radiaquat 6465	5	-	-
Other Components	Alkadet 15	5	5	5
	BIVERT concentrate	10	10	10
	Citric acid	2	2	2
	Propylene Glycol	5	3	3
	Vicamid 825	5	4	4

#### **Example 4**

- 10 A series of formulations were developed to test their stability. It was found that each of the following formulations are stable compositions or semi-stable emulsions at ambient temperature. All proportions are by weight.

Lipophilic solvent	Plant nutrient	Cationic emulsifier	Other components					
Vicamid 825	-	-	-	-	-	-	-	-
Terwet 3001	-	-	-	-	-	-	-	-
Teric N9	-	-	-	-	-	-	-	-
Span 80	7	-	-	-	-	-	-	-
Propylene glycol	-	-	-	-	-	-	-	-
Oleylamine	-	-	-	-	-	5	-	-
Lactic acid	-	-	1	-	3	-	-	-
Ethanol	-	-	-	-	-	-	-	-
Citric acid	-	-	-	1	-	-	-	-
Alkadet 15	4	-	-	-	-	-	-	-
Acetic Acid	-	-	-	-	-	1	-	-
'880' ammonia	-	-	-	-	-	-	-	-
1,3 butanediol	-	-	-	-	-	-	-	-
Radiaquat 6465	11	-	-	-	10	-	-	-
Quatramine NC50	-	-	-	-	-	15	-	-
Quatramine C16/29	-	-	-	-	-	-	-	-
Oxamin LO	-	-	-	-	-	-	-	-
Empigen BB	-	-	-	-	-	-	-	-
Dimethyl laurylamine	-	-	-	-	10	-	-	-
Dimethyl cocoamine	-	-	10	10	-	-	-	-
Cation BB	-	-	-	-	-	-	15	-
Algenc SC25	-	20	-	-	-	-	-	-
Added Water	38	30	30	30	40	30	50	
Urea	-	-	-	-	-	-	-	-
Ammonium sulfate	17	10	10	10	10	15	10	
Ammonium nitrate	-	-	-	-	-	-	-	-
VOC RHT 100	-	-	-	-	-	-	-	-
Tridecanol	-	-	-	-	-	-	10	
Shell P830	-	-	-	-	-	-	-	-
Prorex 36	22	38	-	50	60	-	-	
LOROL C1298	-	2	-	-	-	-	15	
Ethyl oleate	-	-	50	-	-	35	-	
Adjuvant	J	K	L	M	N	O	P	

	Vicamid 825	11.5	9	7.5	90	2	2	2
	Terwet 3001	-	-	-	70	-	-	-
	Teric N9	-	-	-	25	-	-	-
	Span 80	-	-	-	-	11	10	10
	Propylene glycol	7	10	-	-	-	-	-
	Oleylamine	-	-	-	-	-	-	-
	Lactic acid	-	-	-	-	-	-	-
	Ethanol	-	-	-	25	-	-	-
	Citric acid	2.5	1-1.5	1-1.5	-	-	-	-
	Alkadet 15	5	5	5	-	6	7	7
	Acetic Acid	-	-	-	-	-	-	-
	'880' ammonia	-	-	-	5	-	-	-
	1,3 butanediol	-	-	5	40	1	1	2.5
	Radiaquat 6465	-	-	-	-	-	-	-
	Quatramine NC50	-	-	-	-	-	-	-
	Quatramine C16/29	-	10	10	130	-	-	-
	Oxamin LO	-	-	-	-	-	-	-
	Empigen BB	10	10	10	-	-	-	-
	Dimethyl laurylamine	10	-	-	-	-	-	-
	Dimethyl cocoamine	-	-	-	5	-	-	-
	Cation BB	-	-	-	-	16	14	15
	Algene SC25	-	-	-	-	-	-	-
	Added Water	20	20	20	200	58	43	57
	Urea	-	-	-	100	-	-	-
	Ammonium sulfate	10	10	10	-	25	20	24
	Ammonium nitrate	-	-	-	100	-	-	-
	VOC RHT 100	-	-	-	-	-	-	37
	Tridecanol	-	-	-	-	-	-	-
	Shell P830	-	-	-	-	-	43	-
	Prorex 36	-	-	-	-	34	-	-
	LOROL C1298	-	-	-	-	-	-	-
	Ethyl oleate	30	30	30	240	-	-	-
Adjuvant		Q	R	S	T	U	V	W

Other components	Vicamid 825	11	12
	Terwet 3001	22	25
	Teric N9	-	-
	Span 80	22	23
	Propylene glycol	-	-
	Oleylamine	-	-
	Lactic acid	-	-
	Ethanol	6	4
	Citric acid	-	4
	Alkadet 15	-	-
	Acetic Acid	-	-
	'880' ammonia	-	-
	1,3 butanediol	15	15
	Radiaquat 6465	-	-
Cationic emulsifier	Quatramine NC50	-	-
	Quatramine C16/29	-	-
	Oxamin LO	71	70
	Empigen BB	-	-
	Dimethyl laurylamine	-	-
	Dimethyl cocoamine	-	-
	Cation BB	-	-
	Algene SC25	-	-
Plant nutrient	Added Water	121	81
	Urea	-	-
	Ammonium sulfate	55	60
	Ammonium nitrate	-	-
	VOC RHT 100	-	-
	Tridecanol	-	-
	Shell P830	-	-
Lipophilic solvent	Prorex 36	77	80
	LOROL C1298	-	-
	Ethyl oleate	-	-
	Adjuvant	X	Y

The word 'comprising' and forms of the word 'comprising' as used in this description and in the claims does not limit the invention claimed to exclude any variants or additions.

Modifications and improvements to the invention will be readily apparent to those skilled in the art. Such modifications and improvements are intended to be within the scope of this invention.

**THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:**

1. A homogeneous liquid adjuvant for use with a chemical used in agriculture comprising:
  - (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - 5 (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers having cationic characteristics in acidic conditions and mixtures thereof;
- 10 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
2. An adjuvant according to claim 1 comprising:
  - (a) from 5 to 55 % by weight of one or more lipophilic solvents;
  - 15 (b) from 1 to 30 % by weight of one or more lipophobic plant nutrients; and
  - (c) from 1 to 15% of a mixture of one or more cationic emulsifiers.
3. An adjuvant according to claim 2 comprising:
  - (a) from 15 to 35% by weight of one or more lipophilic solvents;
  - 20 (b) from 5 to 25% by weight of one or more lipophobic plant nutrients; and
  - (c) from 1 to 10% of a mixture of one or more cationic emulsifiers.
4. An adjuvant according to claim 1 wherein the lipophilic solvent is selected from the group consisting of petroleum fractions, vegetable oils, synthetic triglycerides, alkyl esters of fatty acids, fatty alcohols, guerbet alcohols or any mixture thereof.
- 25 5. An adjuvant according to claim 4 wherein the lipophilic solvent comprises a petroleum fraction.

6. An adjuvant according to claim 5 wherein the petroleum fraction is a mineral oil.
7. An adjuvant according to claim 4 wherein the lipophilic solvent comprises an alkyl ester of a fatty acid.
8. An adjuvant according to claim 7 wherein the fatty acid of the alkyl ester of a fatty acid has an alkyl moiety derived from the simple alcohols methanol, ethanol, propanol or butanol.
9. An adjuvant according to claim 7 wherein the alkyl ester of a fatty acid is derived from natural oils and fats, specific blends produced by fatty acid manufacturers or from fatty acids produced by synthetic means.
10. An adjuvant according to claim 9 wherein the natural oils and fats are selected from the group consisting of lard, tallow, vegetable oils and mixtures thereof.
11. An adjuvant according to claim 1 wherein the lipophobic plant nutrients comprise one or more ammonium salts of inorganic ions.
12. An adjuvant according to claim 11 wherein the ammonium salts of inorganic ions are selected from the group consisting of ammonium sulfate, ammonium phosphate and mixtures thereof.
13. An adjuvant according to claim 12 wherein the ammonium salt of inorganic ions is ammonium sulfate.
14. An adjuvant according to claim 1 wherein the cationic emulsifiers are selected from fatty amines, fatty amine oxides or mixtures thereof.
15. An adjuvant according to claim 1 wherein the cationic emulsifiers are quaternary cationic emulsifiers.
16. An adjuvant according to claim 1 wherein the cationic emulsifiers are selected from dimethylcocoamine, dimethyllaurylamine oxide, alkyltrimethylammonium chloride, alkyl dimethylbenzylammonium chloride, alkylpyridium chloride, alkylimidazolium chloride, or mixtures thereof.

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17. An adjuvant according to claim 16 wherein the cationic emulsifiers are selected alkyltrimethylammonium chloride, dimethyllaurylamine oxide or mixtures thereof.
18. An adjuvant according to any of the preceding claims further comprising one or more other components to improve the form of the composition.
- 5 19. An adjuvant according to claim 18 wherein the other component is selected from nonionic emulsifiers, co-solvents and mixtures thereof.
20. An adjuvant according to claim 18 wherein the other component is a mixture of one or more nonionic emulsifiers.
- 10 21. An adjuvant according to claim 19 wherein the nonionic emulsifiers are selected from the group consisting of alkyl polysaccharides, sorbate emulsifiers, alcohol ethoxylates, fatty alkanolamides or mixtures thereof.
22. An adjuvant according to claim 18 wherein the other component is a co-solvent.
- 15 23. An adjuvant according to claim 22 wherein the co-solvent is selected from the group consisting of propylene glycol, 1,3-butanediol, hexylene glycol, polypropylene glycols, ethanol or mixtures thereof.
24. An adjuvant according to claim 6 wherein the cationic emulsifiers are quaternary cationic emulsifiers.
- 20 25. An adjuvant according to claim 24 further comprising nonionic emulsifiers selected from the group consisting of alkylpolysaccharides, fatty alkanolamide, sorbitan monooleate, alcohol ethoxylate and mixtures thereof.
26. An adjuvant according to claim 24 further comprising co-solvents selected from the group consisting of 1,3-butanediol, ethanol and mixtures thereof.
27. An adjuvant according to claim 7 wherein at least two cationic emulsifiers are used.
28. An adjuvant according to claim 27 wherein the mixture of cationic emulsifiers comprises fatty quaternary ammonium chlorides and/or fatty amine oxides in conjunction with fatty alkyldimethylamine salts of simple organic acids.

29. An adjuvant according to any of the preceding claims further comprising one or more other available adjuvant components.
30. An agrochemical composition comprising a chemical used in agriculture and an activity enhancing amount of a homogeneous liquid adjuvant, said homogeneous liquid adjuvant comprising:
- 5 (a) not in excess of about 75% by weight of one or more lipophilic solvents;
- (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
- 10 (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
- 15 wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

31. A homogeneous liquid adjuvant when used with a chemical used in agriculture comprising:
- not in excess of about 75% by weight of one or more lipophilic solvents;
  - not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions or mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.
32. A method for enhancing the activity of a chemical used in agriculture comprising the step of combining the chemical with a homogeneous liquid adjuvant comprising:
- not in excess of about 75% by weight of one or more lipophilic solvents;
  - not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;
- wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

33. A method of treating vegetation comprising the step of applying an agrochemical composition comprising a chemical used in agriculture and a homogeneous liquid adjuvant comprising:

  - (a) not in excess of about 75% by weight of one or more lipophilic solvents;
  - (b) not in excess of about 50% by weight of one or more lipophobic plant nutrients; and
  - (c) not in excess of about 50% of a mixture of one or more cationic emulsifiers selected from the group consisting of cationic emulsifiers, emulsifiers which exhibit cationic characteristics in acidic conditions and mixtures thereof;

wherein the cationic emulsifier acts as a coupling agent between the lipophilic solvent and the lipophobic plant nutrient to form a homogeneous liquid composition.

**DECLARATION AND POWER OF ATTORNEY**

As a below named inventor, I HEREBY DECLARE:

THAT my residence, post office address, and citizenship are as stated below next to my name;

THAT I believe I am the original, first, and sole inventor (if only one inventor is named below) or an original, first, and joint inventor (if plural inventors are named below or in an attached Declaration) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**ADJUVANT COMPOSITION FOR CHEMICALS USED IN AGRICULTURE**

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(Attorney Docket No. 038441/0104)

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the specification of which (check one)

is attached hereto.

was filed on May 5, 2000 as United States Application Number or PCT International Application Number PCT/AU00/00416 and was amended on \_\_\_\_\_ (if applicable).

THAT I do not know and do not believe that the same invention was ever known or used by others in the United States of America, or was patented or described in any printed publication in any country, before I (we) invented it;

THAT I do not know and do not believe that the same invention was patented or described in any printed publication in any country, or in public use or on sale in the United States of America, for more than one year prior to the filing date of this United States application;

THAT I do not know and do not believe that the same invention was first patented or made the subject of an inventor's certificate that issued in any country foreign to the United States of America before the filing date of this United States application if the foreign application was filed by me (us), or by my (our) legal representatives or assigns, more than twelve months (six months for design patents) prior to the filing date of this United States application;

THAT I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment specifically referred to above;

THAT I believe that the above-identified specification contains a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the invention, and sets forth the best mode contemplated by me of carrying out the invention; and

THAT I acknowledge the duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I HEREBY CLAIM foreign priority benefits under Title 35, United States Code §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number	Country	Foreign Filing Date	Priority Claimed?
PQ 0175	Australia	May 5, 1999	Yes

I HEREBY CLAIM the benefit under Title 35, United States Code § 119(e) of any United States provisional application(s) listed below.

U.S. Provisional Application Number	Filing Date

I HEREBY CLAIM the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application Number	PCT Parent Application Number	Parent Filing Date	Parent Patent Number

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to have full power to prosecute this application and any continuations, divisions, reissues, and reexaminations thereof, to receive the patent, and to transact all business in the United States Patent and Trademark Office connected therewith.

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I UNDERSTAND AND AGREE THAT the foregoing attorneys and agents appointed by me to prosecute this application do not personally represent me or my legal interests, but instead represent the interests of the legal owner(s) of the invention described in this application.

I FURTHER DECLARE THAT all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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